Design And Fabrication of Multi-Purpose Agricultural Bot

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***Abstract*—More than 60% of the workforce in India is directly or indirectly involved in agriculture. Interest in creating autonomous vehicles like bots in agriculture has risen in response to the present labor shortage. This paper presents a project on Agricultural multipurpose bot aimed at designing, Fabrication and testing an autonomous multipurpose vehicle with efficiency and economic operations for sowing seeds, spraying fertilizers, and disease recognition simultaneously. This vehicle moves through the crop lines and performs tasks, thus reducing requirement of manual intervention.**

I. INTRODUCTION

Agriculture is the backbone of our nation. India being second in the worldwide ranking of farm outputs. As agriculture is so vastly spread in our nation farming becomes the primary occupation for most of the people living in India. Farming is mostly carried out by uneducated villagers who aren't aware about the solutions on various crop related issues. In the past, people have farmed using implements such as bullock carts, tractors, tillers, and more. Labor shortages, a lack of knowledge about soil testing, increased labor expenses, wasted seed and water, and an increase in labor prices are the key challenges confronting agriculture right now. Agricultural bot research and development is driven by a desire to remedy these shortcomings. The bot is an automated machine with a wide range of applications that don't need human intervention. The bot obeys the operator's every order. These bots are intended to do a wide range of tasks, including weeding, spraying crops, and Disease Recognition all while lowering labor costs and increasing efficiency. One of the most significant advantages of agricultural bots is their ability to work around the clock, regardless of weather conditions, decreasing downtime and increasing productivity. Along the route of the robot, several sensors are used to detect and record conditions. The microprocessor at the heart of the robotic system directs all of its actions. Controlling the DC motors, it limits the range of motion for the wheel. A motor driving circuit supplies power to the DC motor, which controls the rate at which the wheel spins.

II. LITERATURE REVIEW

Vishnu Prakash Karunakara et.al: Describes an initiative to create, build, and test an autonomous multifunctional vehicle that meets strict criteria for safety, efficiency, and cost-effectiveness. This self-driving vehicle navigates among the rows of crops on farmland to carry out duties that would otherwise be too time-consuming or dangerous for human workers. Although its primary function is spraying, it may be outfitted with a variety of other configurations as well, including seeding, a plug platform to access the tops of the plants for various operations (pruning, harvesting, etc.), and a trailer to carry the fruits, plants, and crop waste.

Burra Hymavathi, J Hariharan, K Manideep, D V Srikanth et.al: Describes an effort to create a vehicle capable of doing many agricultural tasks at once, including tilling, planting seeds, spraying fertilizer, and sprinkling water, all autonomously. It is solar powered, hands-free, and easy to use in dry or semi-arid regions. The need for human labor is decreased as this vehicle drives between the rows of crops to complete chores.

Chetan Patil, Vishal Deshmukh, Shailesh Deshmukh, Govind rai, Parag Bute et.al: create a robot that can do tasks like automatically ploughing, delivering seeds, and spraying pesticides. It has humidity sensors to keep an eye on the air's moisture content and a human override option for case automatic systems fail. The microcontroller is the important part of this setup since it monitors the whole operation. The robot starts by tilling the whole field, then moves on to ploughing and seed distribution.

III. OBJECTIVES

Develop a cost-effective bot for small and medium farmers.
Perform multiple agricultural tasks with one system.
Reduce manual labor and improve accuracy.
Enhance productivity and sustainability.

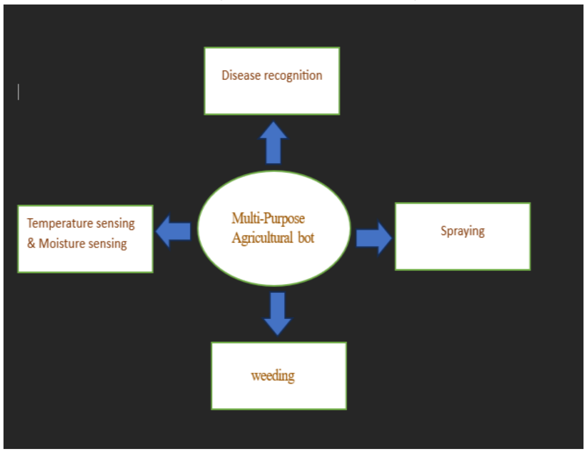

Figure 1: Application of multipurpose robotics solution in agriculture

IV. IMPORTANCE OF AGRICULTURE ROBOT IN 4IR

The Fourth Industrial Revolution (4IR) is characterized by the technological integration that reveals the boundaries between the physical, digital, and biological sectors. 4IR technologies, particularly the utilization of agricultural bots, have the potential to considerably improve the agriculture sector.
Agricultural bots have the following significant impacts:
Precision farming: Sensors and cameras on agricultural bots collect data on soil moisture, nutrient levels, and crop health, which can then be analyzed to optimize farming practices. Precision farming allows farmers to save waste, enhance efficiency, and maximize yields

Labor shortage:
Several nations are facing a labor shortfall in the agriculture industry, which can be handled by using bots. Planting, harvesting, and weeding duties may be performed by agricultural bots, freeing up human work. Planting, harvesting, and weed management duties can be performed by agricultural bots, freeing up human labor for other activities.

Sustainability:
Agricultural bots can assist farmers in adopting more sustainable farming techniques. bots, for example, could be utilized to precisely apply fertilizers and insecticides, eliminating waste and minimizing environmental effect.

Cost savings:
Farmers may cut labor expenses and boost production by deploying bots, which can result in considerable cost savings.

Safety:
Farm robots may undertake activities that humans find unsafe, such as working in adverse weather or handling hazardous products.
Overall, the deployment of agricultural robots in the 4IR can improve agricultural efficiency, production, sustainability, and safety.

V. EXISTING SYSTEM VS PROPOSED SYSTEM

The lack of available farm workers, a lack of knowledge about the need of soil testing, rising labor prices, disappearing seeds, and dwindling water supplies are the most pressing problems facing modern agriculture today. All of these difficulties have inspired the proposal to use bots in farming. The main purpose of agricultural bots is to use bot technology to farming.
The bot is an automated machine with a wide range of applications that don't need human intervention. The bot obeys the operator's every order. Along the route of the bot, several sensors are used to detect and record conditions. The microprocessor at the heart of the robotic system directs all of its actions. Controlling the DC motors, it limits the range of motion for the wheel. A motor driving circuit is responsible for powering the DC motors that turn the wheels. The autonomous sowing bot used in agriculture may be controlled from a distance using a Smartphone and Bluetooth wireless technology. A Bluetooth electronic app is used to

operate the bot. It's used to control the bot's every move.

VI. SYSTEM ARCHITECTURE

Block diagram

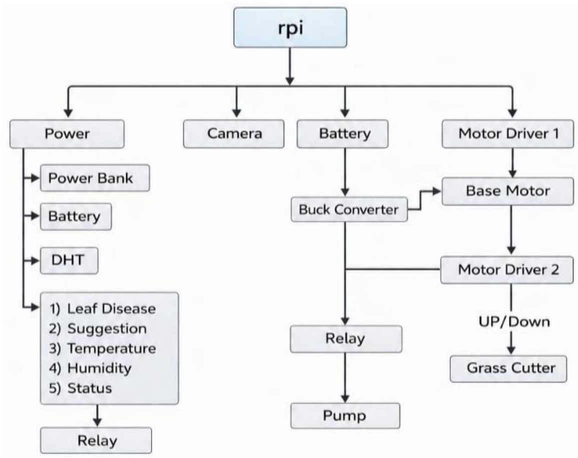

Fig 2: Block Diagram of multipurpose agricultural bot

Components

1. Raspberry Pi

The Raspberry Pi acts as the "brain," managing complex tasks like real-time image analysis, autonomous navigation, and cloud communication. For a disease detection bot, its functions are typically divided into sensing, processing, and acting.

Fig 3: Raspberry Pi

2. Relay

The relay acts as an electrically operated switch. Because the Raspberry Pi operates at low voltage (3.3V) and low current, it cannot directly power heavy equipment like water pumps or sprayers without damaging its internal circuitry.

Fig 4: Relay

3. DHT Sensor

The DHT sensor (typically the DHT11 or DHT22) acts as the bot's "environmental monitor." While the camera detects diseases visually, the DHT sensor measures the ambient temperature and humidity to understand *why* a disease might be occurring or to predict future outbreaks.

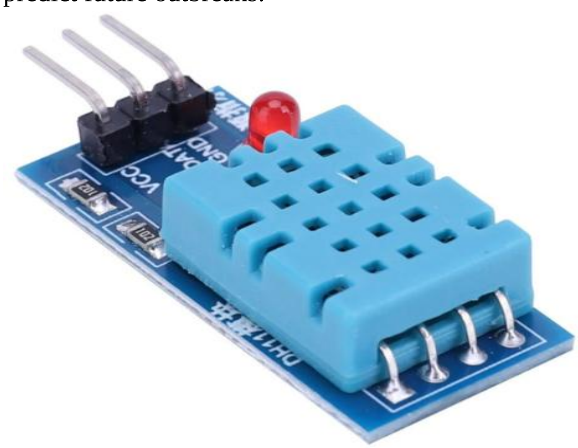

Fig 5: DHT Sensor

VII. PROPOSED AGRICULTURAL BOT

We made a farming robot that uses a computer to recognize diseases in plants and then removes weeds and sprays pesticides on its own. The robot has a camera that takes pictures of the crops and a small computer that looks at these pictures to figure out what is wrong with the plants. When it finds a problem, the robot gets rid of the weeds. Sprays the right amount of pesticide. This helps farmers because they do not have to do much work and they use fewer chemicals. The robot is controlled by a computer called a Raspberry Pi that tells the robot what to do and when to do it. The Raspberry Pi looks at what the sensors are saying, processes the pictures and controls the motors and sprayers. This means the robot can work on its own in the field.

The robot is good for farmers because it helps them take care of their crops better it is good, for the Earth because it uses chemicals and it shows that smart farming robots can really work.

The Raspberry Pi is the brain of the robot. It makes sure everything works together to keep the crops healthy. This proposed agricultural bot reduces human effort, increases operational efficiency, minimizes pesticide wastage, and promotes sustainable farming practices. The system demonstrates the practical implementation of smart agriculture technologies by combining machine learning, automation, and robotics into a single multifunctional platform.

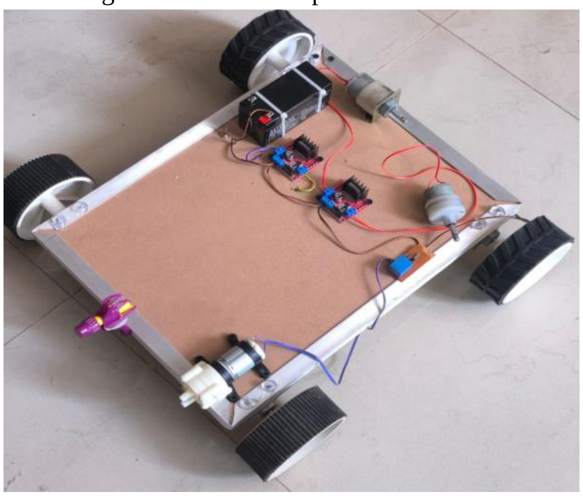

Fig 6: Initial stage of multipurpose agricultural bot

Fig 7: Final stage of multipurpose agricultural bot

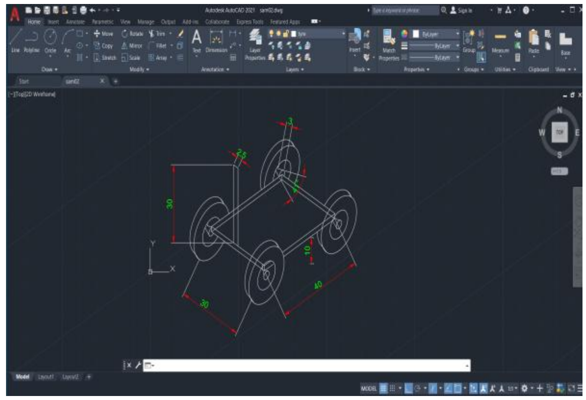

Fig 8: - Cad Drawing of Multipurpose agricultural bot

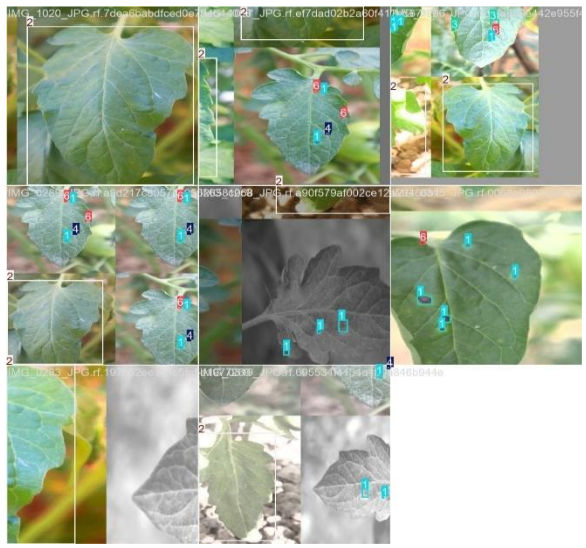

Fig 9: Diseases recognized by Multipurpose bot

VIII. CONCLUSION

The agricultural bot that was made shows how machine learning and robotics and other systems can be used for farming. It uses a Raspberry Pi to control it. It can find diseases in plants and get rid of weeds and spray pesticides all at the same time. It does all these things with accuracy and it is more efficient. The machine learning part of it can tell what is wrong with the plants away. The robot can also. Get rid of weeds on its own which means people do not have to do it by hand. This also means that we do not use many chemicals.

The system that was proposed is good for farming today because it helps us take care of plants better and it saves people money. It also helps us farm in a way that's good for the earth. The robot can do things at the same time which means farmers can get more work done and they have more time. The agricultural bot also shows how artificial intelligence and other technologies can change the way we farm. It can make farming smarter and more efficient. The agricultural bot can make a difference, in farming.

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